Cathodoluminescence and EBSD observations on quartz phenocrysts from a weakly deformed granite porphyry in the Ryoke belt, Awaji Island, SW Japan.

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Introduction:Cathodoluminescence (CL) is sensitive to defects and/or impurities in crystals. CL images have been used to observe microstructures within grains to understand mineral growth and diagenetic processes (Götze 2009). It has also been used in structural geology to observe patterns of healed fractures, subgrain boundaries (SGBs), and twins (Shimamoto et al 1991; Hamers et al 2017). We observed deformed quartz phenocrysts with different degrees in mylonitized granite porphyries reported by Kano and Takagi (2013). In CL images of the deformed quartz phenocrysts, some planar deformation features (PDFs) can be observed. In this study, we analyzed the CL images and EBSD maps of the weakly deformed quartz phenocryst to clarify the formation processes of PDFs observed in CL images. In addition, we will evaluate impurity distribution within quartz phenocrysts by EPMA compositional maps and FT-IR H_2O concentration maps.

Results and Discussion:Quartz phenocrysts exhibit an undulose extinction indicative of internal plasticity under the optical microscope. Kernel Average Misorientation (KAM) maps and orientation difference profile normal to the extension direction of an undulose extinction show misorientation angles between two adjacent pixels are less than 2°. SGBs with a misorientation angle of no less than 0.4° can be assigned to almost all the PDFs. In pole figures, the crystallographic axes and planes of quartz are rotated around the *c*-axis, and the misorientation axes distribute parallel to the *c*-axis, indicating a dominant prism <*a*> slip system. Our observations suggest that SGBs under the optical and EBSD observations can be comparable with the PDFs in CL images, implying that the PDFs in CL images can be derived from the accumulation of defects to SGBs. Furthermore, we estimated the stress applied to quartz phenocryst based on the subgrain size piezometer of Goddard et al (2020). Given the misorientation angle of 1°, the subgrain size is 29 μm, and the estimated stress is 14 MPa.

References**:** Goddard et al (2020) Geophys Res Lett 47:e2020GL090056; Götze (2009) Mineral Mag 73:645–671; Hamers et al (2017) Phys Chem Mineral 44:263–275; Kano and Takagi (2013) Geol Soc Japan 119:776–793; Shimamoto et al (1991) J Struct Geol 13:967–973.

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